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Research Article

A taxonomic update to *Pachymelus* (*Pachymelopsis*) Cockerell, with a new species from Ethiopia (Hymenoptera, Apidae)

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Abstract

Pachymelus Smith, 1879, is a small bee genus comprising 21 species restricted to sub-Saharan Africa and Madagascar. Despite the small size of the genus, several uncertainties persist within the subgenus *Pachymelus* (*Pachymelopsis*) Cockerell, 1905, which contains five species and is restricted to sub-Saharan Africa. Based on a revision of museum material and inspection of contemporary collections, a number of changes are implemented. *Pachymelus bettoni* (Cockerell, 1910), described in the male sex, was incorrectly considered to be a distinct species; it is actually the male of *Pachymelus* (*Pachymelopsis*) *conspicuus* Smith, 1879, **syn. nov.**, and is returned to synonymy with it. *Pachymelus* (*Pachymelopsis*) *armatipes* (Friese, 1911), **stat. rev.** is returned to species status, having been incorrectly considered conspecific with *P. conspicuus*. *Pachymelus* (*Pachymelopsis*) *haladai* **sp. nov.** is described from Ethiopia. A lectotype is designated for *Habropoda capensis* Cameron, 1905 (= *Pachymelus festivus* (Dours, 1869)) from material that was previously considered lost; the species is newly reported from East Africa (Kenya), and the status of *Afromelecta lieftincki* Eardley, 1991 is discussed. The type locality of *Pachymelus* (*Pachymelopsis*) *abessinicus* (Friese, 1912) is clarified, moving from Uganda to Kenya, which is shown to host five of the now six members of this subgenus. These revisions further illustrate the need for greater survey effort and taxonomic revision of bees in dry parts of Eastern Africa.

Key Words

Anthophorinae, Eastern Africa, lectotype, sex association, solitary bees, synonymy

Introduction

The genus *Pachymelus* Smith, 1879 is endemic to sub-Saharan Africa and Madagascar and contains 21 species, with 15 from Madagascar and six from continental Africa (Eardley 1993; Pauly et al. 2001; Michener 2007; Ascher and Pickering 2025). The phylogenetic position of *Pachymelus* has recently received attention, as it appears to be basal within the subfamily Anthophorinae (Bossert et al. 2019; Orr et al. 2022), suggesting an African origin for this whole clade of bees.

The genus is divided into two subgenera, *Pachymelus* s. str. (16 species) and *Pachymelopsis* Cockerell, 1905 (five species), with *Pachymelus* s. str. found almost entirely on the island of Madagascar and *Pachymelopsis* restricted to continental Africa. *Pachymelopsis* was described as a genus to accommodate the species *Pachymelus conspicuus* Smith, 1879, which was described from "Nyassa", today probably referable to Malawi, and Cockerell defined it purely in opposition to the Madagascan *Pachymelus micrelephas* Smith, 1879, the type species of *Pachymelus*. Since then, a broad consensus has emerged that *Pachymelopsis* is best treated as a subgenus of *Pachymelus* (Brooks 1988; Eardley 1993; Pauly et al. 2001; Michener 2007, though see Baker 1993). Eardley (1993) recognised six African species in *Pachymelus* (*Pachymelopsis*), and Pauly et al. (2001) recognised 15 Madagascan species in *Pachymelus* s. str.

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However, Michener (2007: 751) considered *Pachymelus peringueyi* (Friese, 1911) (South Africa and Namibia) to belong to *Pachymelus* s. str. Following Michener, the two subgenera therefore do not have allopatric distributions, with *Pachymelus* s. str. not entirely confined to Madagascar. Phylogenetic data from *Pachymelus* (*Pachymelopsis*) are also lacking, with all species sequenced to date belonging to *Pachymelus* s. str. sensu Michener (Bossert et al. 2019; Orr et al. 2022). Additional phylogenetic work is needed, but pending such revisions, the subgeneric concepts of Michener (2007) are followed here.

Although the revision of Eardley (1993) was comprehensive, including inspection of all relevant type material, examination of additional museum specimens and recent collections has uncovered novelties within *Pachymelus* (*Pachymelopsis*). The opportunity is taken to present new data and expand known distributional ranges, clarify a few outstanding issues including sex associations, illustrate type material photographically, and describe a new distinctive *Pachymelus* (*Pachymelopsis*) species from Ethiopia.

Methods

It was possible to study 133 specimens of *Pachymelus* (*Pachymelopsis*) in collections, including relevant type material. Morphological terminology and generic and subgeneric concepts follow Michener (2007), with the exception of the marginal "zones" of the terga, which are referred to as marginal "areas". Following taxonomic changes, the identification key of Eardley (1993) is updated to cover all *Pachymelus* (*Pachymelopsis*) species in sub-Saharan Africa. Photographs were taken using an Olympus E-M1 Mark II with a 60 mm macro lens. Additional close-ups were taken with a Mitutoyo M Plan Apo 10× infinity-corrected objective lens in combination with an Olympus M.Zuiko 2× teleconverter lens, a 10 mm Kenko DG extension tube, and a Meike MK-P-AF3B 10 mm extension tube. Photographs were stacked using Helicon Focus B (HeliconSoft, Ukraine), and plates were prepared in GNU Image Manipulation Program (GIMP) 2.10. Post-processing of some images was done in Photoshop Elements (Adobe Systems, USA) to improve lighting and highlight specific characters.

To ensure unambiguous attribution, personal names mentioned in the text are, at first mention, accompanied by their corresponding GND (Integrated Authority File) identifier, when possible, available at https://www.dnb.de/EN/Professionell/Standardisierung/GND/gnd_node.htm.

Abbreviations

MNHN Museum nationale d'Histoire naturelle, Paris, France

NHMUK Natural History Museum, London, United Kingdom

OÖLM Oberösterreiches Landesmuseum, Linz, Austria

OUMNH Oxford University Museum of Natural History, Oxford, United Kingdom

RMNH Naturalis Biodiversity Center, Leiden, the Netherlands

TJWC Personal collection of Thomas J. Wood, Leiden, the Netherlands

ZMB Museum für Naturkunde, Berlin, Germany

Results

Pachymelus (*Pachymelopsis*) *abessinicus* (Friese, 1912)

Anthophora aethiopica Friese, 1911: 659, ♂ non ♀ nec. Cameron [Kenya, ZMB, not examined]

Anthophora abessinica Friese, 1912: 89 nom. nov. *pro Anthophora aethiopica* Friese

Notes. Eardley (1993) summarised the nomenclatural situation surrounding Friese's names and designated a male lectotype, as the females described by Friese actually belong to an *Amegilla* species. This lectotype designation fixed the type locality as "Br. O. Afrika, Mulango, 1908, Sauberlich [sic]". Eardley stated this to refer to Mengo in Uganda. However, consideration of the collector of this specimen must be made to inform this choice.

Günther Albin Säuberlich (1864–1946, https://explore.gnd.network/gnd/1068413840) was an evangelical Lutheran missionary who worked in East Africa on and off between 1888 and 1912 (Bauer and Hörnlein 2005). Between 1906 and 1912 he was based at Mulango in southern Kenya, which is located at –1.4272°S, 38.0120°E, approximately 115 km east of Nairobi. The spelling of this place name matches that on the type label, and British East Africa almost invariably refers to modern Kenya, not Uganda, which was most commonly referred to as the Uganda Protectorate or simply Uganda. Kenya must therefore be considered the *terra typica*, not Uganda. Friese (1911: 660) also mentioned males from Madibura [Madibira] and Murutunguru-Ukerewe [Ukerewe Island] in Deutsch Ost Afrika (= Tanzania), and these are considered valid country records at present.

Distribution. Kenya and Tanzania (Friese 1911).

Pachymelus (*Pachymelopsis*) *armatipes* (Friese, 1911) stat. rev.

Anthophora armatipes Friese, 1911: 660, ♀♂ ["Somaliland", ZMB, not examined]

Material examined. Ethiopia • 2♂; Jowaha N. of Debra Sina; 6,000 ft a.s.l.; 7 Aug. 1946; K.M. Guichard leg.; D.B. Baker det. 1979; NHMUK; Kenya • 1♂; Brit. E. Af., Mtito Andei; 2,500 ft a.s.l.; 26–28 Mar. 1911; S.A. Neave leg.; D.B. Baker det.; 1982; NHMUK; • 2♀; E of

Mwingi; 14 May 2007; M. Halada leg.; T.J. Wood det.; OÖLM/TJWC • 1♀; Taita Hills, Voi river; 14 Apr. 2007; T.J. Wood det.; OÖLM.

Notes. The situation surrounding three taxa, *P. conspicuus*, *Pachymelus bettoni* (Cockerell, 1910), and *P. armatipes*, has been confused. Brooks (1988) considered all three to be conspecific, but Eardley (1993) treated *P. conspicuus* (inclusive of *P. armatipes*) and *P. bettoni* as two distinct species. This case requires clarification, as *P. conspicuus* was described from a single female (Fig. 1), *P. bettoni* from a single male (Fig. 2), and *P. armatipes* in both sexes.

Friese (1911) provided a diagnosis for *P. armatipes* against *P. festivus* (Dours, 1869), citing the larger size, different female colouration, and long hair fringe on the male fore basitarsus. Eardley (1993: 220–221) argued that the female of *P. armatipes* was conspecific with *P. conspicuus*, and since the sexes of the type series were "apparently" correctly associated, the male of *P. armatipes* must therefore be the male of *P. conspicuus*, as "no evidence was available for the association of the holotype of *P. bettoni* with that of *P. conspicuus*".

Eardley's synonymy of *P. armatipes* was unjustified, as (1) there are morphological differences in pubescence between the females of *P. armatipes* and *P. conspicuus*, and (2) there was no effort to associate sexes across the observed ranges of the possible taxa to provide additional support for or against a particular association. While *P. conspicuus* females have dense and fine tergal pubescence (Fig. 1D), *P. armatipes* females have thicker hairs on the terga, giving an almost scaly appearance (Fig. 3D). The scutal pubescence of *P. conspicuus* is also finely intermixed greyish and dark brown hairs (Fig. 1C), whereas in *P. armatipes* the pubescence is rich reddish-brown with only a few intermixed black hairs (Figs 3A, 3C). There are also slight differences in body size, with female *P. conspicuus* measuring around 15–16 mm and *P. armatipes* around 16–18 mm (see Friese 1911: 661), and in the colouration of the yellow facial markings, which are lemon yellow in *P. conspicuus* (Fig. 1C) and ivory yellow in *P. armatipes* (Fig. 3B).

Concerning males, examination of specimens has found *P. conspicuus* females with *P. bettoni* males flying together at the same site on the same day in four locations (Kenya = 3, Zambia = 1; full material examined listed below under *P. conspicuus*). In fact, the specimens from Zambia were critical to understanding the sex association, as males displaying the morphology of *P. armatipes* have only been examined from Ethiopia (Fig. 4) and Kenya, whereas "*P. bettoni*" males have been examined extending south through Tanzania to Zambia, covering the known range of *P. conspicuus* based on female specimens.

Figure 1. *Pachymelus conspicuus* Smith, 1879 holotype female (NHMUK). **A.** Label details; **B.** Body, dorsal view; **C.** Head and mesosoma, anterolateral view; **D.** Metasoma, dorsal view.

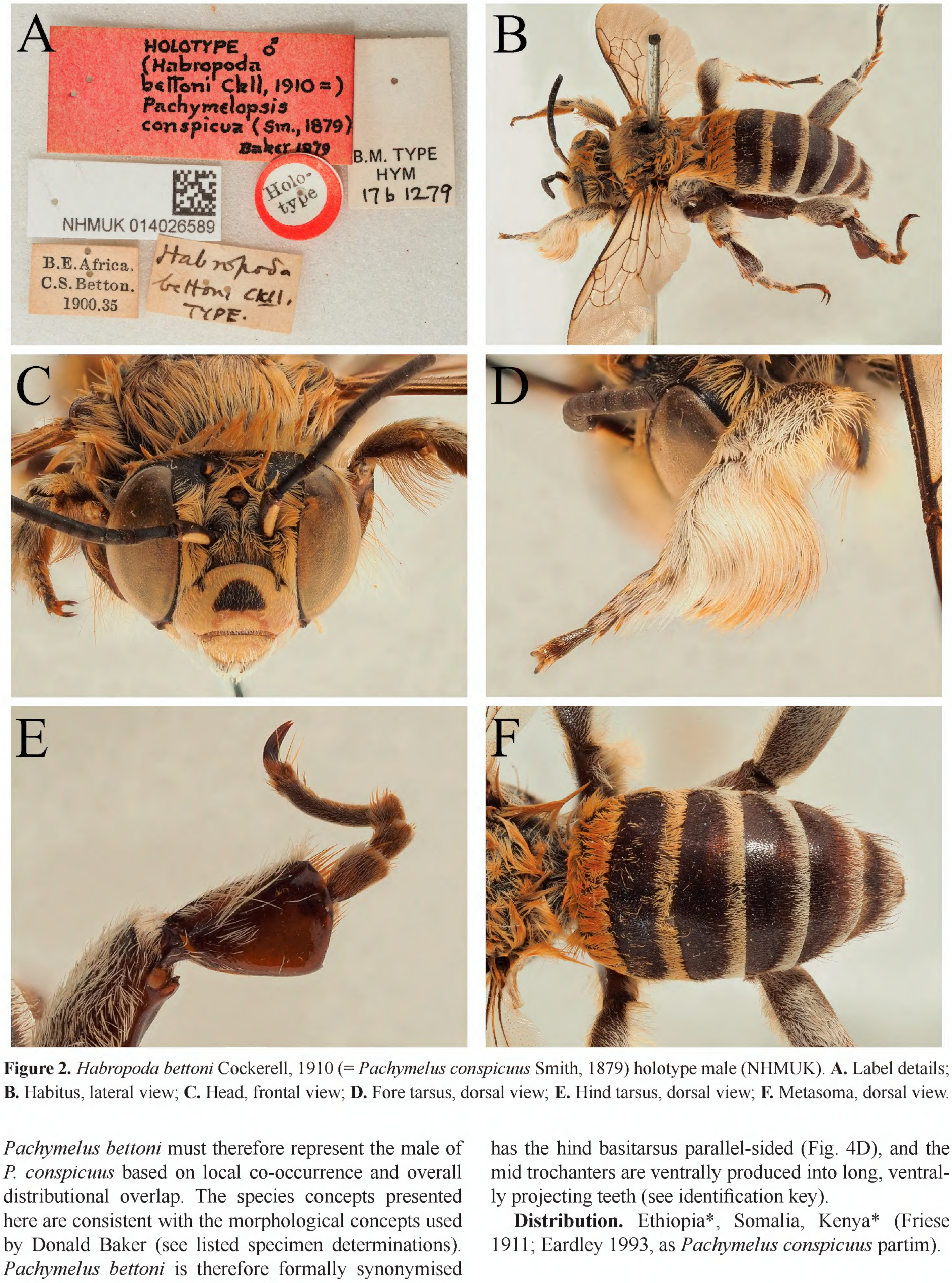

Figure 2. *Habropoda bettoni* Cockerell, 1910 (= *Pachymelus conspicuus* Smith, 1879) holotype male (NHMUK). **A.** Label details; **B.** Habitus, lateral view; **C.** Head, frontal view; **D.** Fore tarsus, dorsal view; **E.** Hind tarsus, dorsal view; **F.** Metasoma, dorsal view.

Pachymelus bettoni must therefore represent the male of *P. conspicuus* based on local co-occurrence and overall distributional overlap. The species concepts presented here are consistent with the morphological concepts used by Donald Baker (see listed specimen determinations). *Pachymelus bettoni* is therefore formally synonymised with *P. conspicuus* below, and *P. armatipes* stat. rev. is restored to species status. The males are easily separable, as *P. conspicuus* has the hind basitarsus apically broadened and thus appearing triangular (Fig. 2E), and the mid trochanters are ventrally rounded, whereas *P. armatipes* has the hind basitarsus parallel-sided (Fig. 4D), and the mid trochanters are ventrally produced into long, ventrally projecting teeth (see identification key).

Distribution. Ethiopia*, Somalia, Kenya* (Friese 1911; Eardley 1993, as *Pachymelus conspicuus* partim).

Pachymelus (*Pachymelopsis*) *conspicuus* Smith, 1879

Pachymelus conspicuus Smith, 1879: 117, ♀ [Malawi, NHMUK, examined] (Fig. 1).

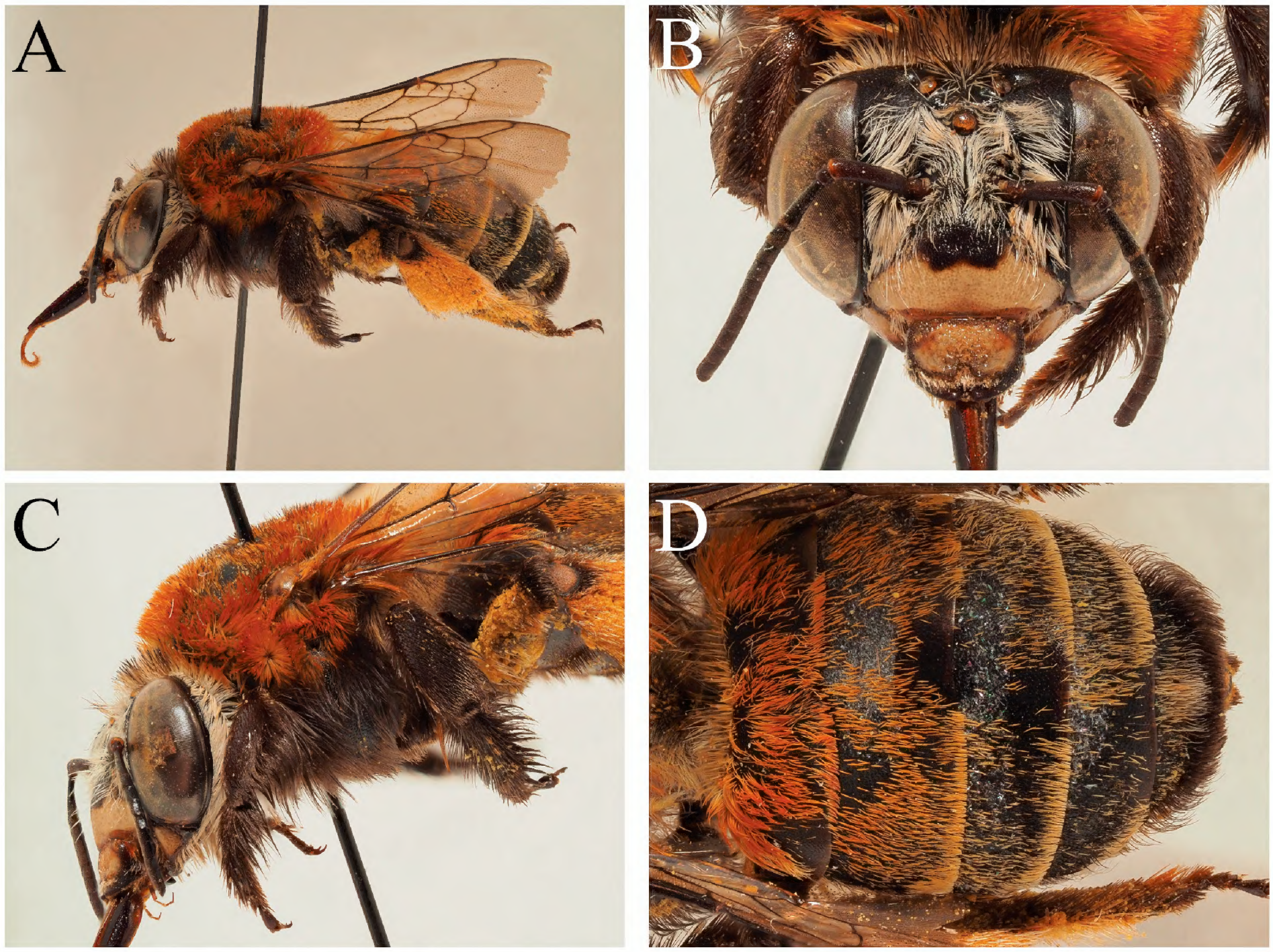

Figure 3. *Pachymelus armatipes* (Friese, 1911) female (OÖLM). **A.** Habitus, lateral view; **B.** Head, frontal view; **C.** Head and mesosoma, anterolateral view; **D.** Metasoma, dorsal view.

Pachymelus insulanus Stadelmann, 1898: ♀ [Tanzania, ZMB, not examined].

Habropoda bettoni Cockerell, 1910: 215, ♂ [Kenya, NHMUK, examined] (Fig. 2) syn. nov.

Material examined. **Ethiopia** • 1♂; Abyssinia, Busika; 5 Nov. 1911; R.J. Stordy leg.; T.J. Wood det.; NHMUK • 1♂; Abyssinia, Higo Samula; 30 Oct. 1911; R.J. Stordy leg.; T.J. Wood det.; NHMUK; **Kenya** • 1♂; B.E. Africa; C.S. Betton leg.; NHMUK (holotype of *Habropoda bettoni*) • 1♂, 1♀; Brit. E. Af., 30 miles from Magadi Junc.; 1–30 Apr; 1912; F.G. Hamilton leg.; T.J. Wood det.; NHMUK • 1♀; Brit. E. Af., Kibwezi; 3,000 ft a.s.l.; 2–4 Apr. 1911; S.A. Neave leg.; T.J. Wood det.; NHMUK • 1♂, 1♀; Brit. E. Af., Mtito Andei; 2, 500 ft a.s.l.; 26–28 Mar. 1911; S.A. Neave leg.; T.J. Wood det.; NHMUK • 1♀; Brit. E. Af., Voi; 8–10 Feb. 1912; S.A. Neave leg.; T.J. Wood det.; NHMUK • 1♂; Brit. E. Africa, E. shore Vic. Nyanza, near Karungu; 28–29 Apr. 1911; S.A. Neave leg.; T.J. Wood det.; NHMUK • 1♂; Brit. E. Africa, Kuja Valley, S. Kavirondo; 4,000 ft a.s.l.; 30 Apr. – 1 May 1911; S.A. Neave leg.; T.J. Wood det.; NHMUK • 1♂, 1♀; Nzoi [probably Nzaui Hill], Ukambani Country; 1 Jan. – 28 Feb. 1889; F.J. Jackson leg.; NHMUK • 8♂, 2♀; Taita Hills, Voi river; 14 Apr. 2007; M. Halada leg.; OÖLM/TJWC • 1♀; Voi (Tsavo) env.; 22 Nov. – 2 Dec. 1996; Mi. Halada leg.; OÖLM • 1♀; Afrique Orient. Angl., Kibwezi (Wa-Kamba); 1904; Ch. Alluaud leg.; T.J. Wood det.; MNHN; **Malawi** • 1♀; [label illegible]; NHMUK (holotype of *Pachymelus conspicuus*); **Tanzania** • 1♂; German E. Africa, Stigi [?Sijiji Hill]; 19 Apr. 1917; Dr. G.D.H. Carpenter leg.; T.J. Wood det.; NHMUK • 1♂; Mkomazi Game Res., Mbula Hill; 25 Dec. 1994; G.N. Stone leg.; T.J. Wood det.; OUMNH • 1♀; Rukwa Valley, Tanganyi a.; 1–31 May 1953; FitzGerald leg.; T.J. Wood det.; NHMUK • 1♀; Tanganyika: Old Shinyanga; 23 Mar. 1952; E. Burtt leg.; G.E.J. Nixon det.; 1958; NHMUK • 1♂; W. Shore of K. Manyara; 1 Feb. – 31 May 1935; B. Cooper leg.; T.J. Wood det.; NHMUK; **Zambia** • 1♀; N. Rhodesia, Road to Nangereri; 6 Feb. 1911; Silverlock leg.; T.J. Wood det.; NHMUK • 4♂, 2♀; N.E. Rhodesia, Up. Luangwa Valley; 1800–2000 ft a.s.l.; 8–9 Mar. 1908; S.A. Neave leg.; D.B. Baker det. 1988; OUMNH • 2♂; N.E. Rhodesia, Up. Luangwa Valley; 1800–2000 ft a.s.l.; 22–26 Mar. 1908; S.A. Neave leg.; D.B. Baker det. 1988; OUMNH • 1♀; Siovonga [Siavonga]; 11 Apr. 1981; G.G.M. Schulten leg.; C. Eardley det. 1993; RMNH.

Notes. Although *P. conspicuus* was nominally reported from Ethiopia by Eardley (1993), the specific male specimens cited were actually *P. armatipes*. The presence

Figure 4. *Pachymelus armatipes* (Friese, 1911) male (NHMUK). **A.** Label details; **B.** Habitus, lateral view; **C.** Fore tarsus, dorsal view; **D.** Hind tarsus, dorsal view.

of *P. conspicuus* in Ethiopia is supported by the additional specimens presented above, although the exact localities within "Abyssinia" cannot currently be traced. As discussed above, it is appropriate to synonymise *P. bettoni* under *P. conspicuus* as its male.

Distribution. Ethiopia, Kenya, Tanzania, Malawi, Zambia, Namibia (Smith 1879; Cockerell 1910; Eardley 1993, as *Pachymelus conspicuus* partim and *Pachymelus bettoni*).

Pachymelus (*Pachymelopsis*) *festivus* (Dours, 1869)

Habropoda festiva Dours, 1869: 33, ♀♂ [South Africa, type lost?].

Habropoda capensis Cameron, 1905: 255, ♀ [South Africa, NHMUK, lectotype by present designation] (Fig. 5).

Material examined. Kenya • 1♂, 2♀; Brit. E. Af., 30 miles from Magadi Junc.; 1–30 Apr. 1912; F.G. Hamilton leg.; T.J. Wood det.; NHMUK • 1♂; Brit. E. Africa, Magadi Ry.; 1–31 May 1912; F.G. Hamilton leg.; T.J. Wood det.; NHMUK • 1♂; Magadi; 7 Apr. 1912; F.G. Hamilton leg.; T.J. Wood det.; NHMUK • 6♀; Ngong; 1–30 Jun. 1944; V.G.L. van Someren leg.; T.J. Wood det.; NHMUK • 2♀; Nzoi [probably Nzaui Hill], Ukambani Country; 1 Jan. – 28 Feb. 1889; F.J. Jackson leg.; T.J. Wood det.; NHMUK • 1♀; Mission de l'Omo, Machacos [Machakos], Wa-Kamba; 1600 m a.s.l.; 1932–1933; C. Arambourg, P.-A. Chappuis, R. Jeannel leg.; T.J. Wood det.; MNHN; **Lesotho** • 1♂; Basuto Land, between Motsekuwa [Motsekuoa] and Mafetina [Mafeteng]; 30 Mar. 1902; R. Crawshay leg.; D.B. Baker det. 1979; NHMUK • 1♂, 2♀; Basutoland; R. Crawshay leg.; T.J. Wood det.; NHMUK; **South Africa** • 1♀; Africa: Belmont; 23 Feb. 1934; J. Ogilvie leg.; T.J. Wood det.; NHMUK • 1♀; Cape Colony; ex. P. Cameron collection 1905-192; NHMUK (lectotype of *Habropoda capensis*) • 1♀; Cape G. H. [Cape of Good Hope]; ex. F. Smith collection 1879.22; T.J. Wood det.; NHMUK • 1♀; Kwazulu, Blood River Mem.; 22 Feb. 2000; G.G.M. Schulten leg.; T.J. Wood det.; RMNH • 1♂, 1♀; O.R. Colony, Bloemfontein; 4,500 ft a.s.l.; 1 Dec. 1894 – 31 May 1895; F.N. Brown leg.; D.B. Baker det. 1988; OUMNH • 1♀; Orange Free State, Donkerspoort; 18 Apr. 1934; J. Ogilvie leg.; T.J. Wood det.; NHMUK • 1♂; Willowmore, Capland; Dr. Brauns leg.; T.J. Wood det.; Accessioned 1912-95; NHMUK • 4♂, 1♀; Colonie du Cap, Steynsburg; 1914; R. Ellenburger leg.; T.J. Wood det.; MNHN • 1♂, 1♀; Colonie du Cap, Steynsburg; 1915; R. Ellenburger leg.; T.J. Wood det.; MNHN.

Figure 5. *Habropoda capensis* Cameron, 1905 (= *Pachymelus festivus* (Dours, 1869)) lectotype female (NHMUK). **A.** Label details; **B.** Habitus, lateral view; **C.** Head, frontal view; **D.** Terga, dorsal view.

Notes. Although most type material of Dours is considered lost, *P. festivus* was described using material from the collections of both Jean Antoine Dours and Frédéric Jules Sichel, the latter of which may still be preserved in the Paris museum, although a recent search could not locate any syntypic specimens. Although the type material is currently treated as lost (Eardley 1993), the concept and use of the name *P. festivus* are well established in the literature and in collections; only two *Pachymelus* species occur around the Cap de Bonne-Espérance (Cape of Good Hope, the *locus typicus*), the description is consistent with its current use, and so it is not considered necessary to designate a neotype.

Equally, the identity of *Habropoda capensis* has been considered straightforward for the same reasons, and the synonymy was made almost immediately (Friese 1905: 233). Eardley (1993: 222) noted that the "holotype" of *H. capensis* was lost, as it could not be found at the Albany Museum (Grahamstown, now Makhanda, South Africa). However, Cameron (1905: 256) wrote: "Cape Colony. (Brak Kloof); Transvaal.", clearly indicating that at least two specimens must have been used to describe the species, given the two reported regions. There is also no specific reference to the Albany Museum in the entry for *H. capensis*, as Cameron stated at the beginning of the paper that specimens dealt with in that work were from various private collectors, the Albany Museum collection, and specimens placed in his own collection.

Examination of the NHMUK collection has produced a female labelled in Cameron's distinctive handwriting as coming from Cape Colony (Fig. 5). The specimen bears the accession number 1905-192, indicating that it was received by the NHMUK in the year 1905, i.e. in the same year as the description of the species. As it was clearly inspected by Cameron and comes from one of the stated localities (Cape Colony), it can be treated as syntypic and is hereby designated as the lectotype. Morphologically, the specimen conforms to the concept of *P. festivus* employed in the literature (e.g. Friese 1905; Eardley 1993).

Finally, specimens of *P. festivus* were unexpectedly found from southern Kenya in both the NHMUK and MNHN collections (Figs 6, 7). The published distributional range was considered to be South Africa and Lesotho (Eardley 1993), but multiple specimens collected by F. J. Jackson, F. G. Hamilton, V. G. L. van Someren, C. Arambourg, P.-A. Chappuis, and R. Jeannel from a small area of south-western Kenya not far from Nairobi were morphologically consistent with southern African specimens, with very minor yellow markings on the female mandibles (Fig. 6C; see identification key). This emphasises the

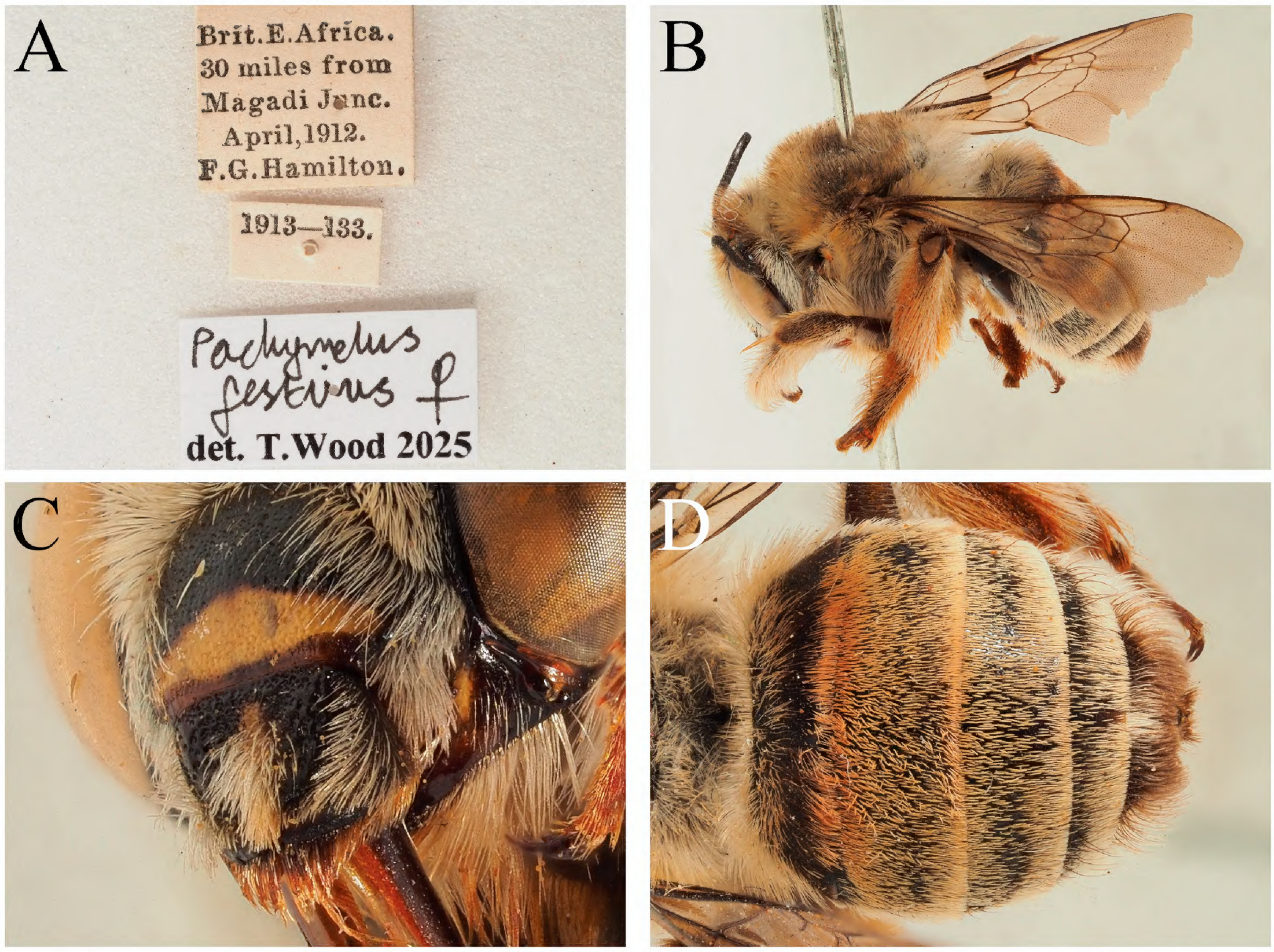

Figure 6. *Pachymelus festivus* (Dours, 1869) female (NHMUK). **A.** Label details; **B.** Habitus, lateral view; **C.** Lower part of head, anterolateral view; **D.** Terga, dorsal view.

emerging biogeographic link observed in bees between southern Africa and southern Kenya (Ascher and Engel 2017; see Discussion).

This has potential implications for a different but potentially ecologically related genus of bees, the parasitic lineage *Afromelecta* Lieftinck, 1972 (Apidae: Melectini). Originally described based on the species *Afromelecta fulvohirta* (Cameron, 1905), which is considered restricted to South Africa (Lieftinck 1972), Eardley (1991) described *Afromelecta lieftincki* Eardley, 1991 from a single specimen from southern Kenya (Fig. 8). Examination of the collecting information reveals that it is from Machakos and was collected by C. Arambourg, P.-A. Chappuis, and R. Jeannel between 1932 and 1933 (Fig. 8A; cited as 1922–1933 by Eardley 1991: 3), which is the same collecting information as for the MNHN specimen of *P. festivus*. Brauns (1926) cited *P. festivus* as the host of *A. fulvohirta* (as *Habropoda festiva* and *Epeolus fulvohirtus*, respectively), as mentioned by Lieftinck (1972: 315), although the latter author expressed caution regarding this proposed host association given the diversity of anthophorine bees in South Africa.

The concurrent (as far as can be inferred given the lack of precise dates) capture of *A. lieftincki* and *P. festivus* in Kenya and *A. fulvohirta* and *P. festivus* in South Africa (see also material collected by R. Ellenburger) is suggestive, but given the small number of specimens involved, no action is taken here. The hypothesis that *A. lieftincki* is simply an isolated population of *A. fulvohirta*, with both taxa attacking *P. festivus*, is proposed here but requires additional study and field validation.

Distribution. South Africa, Lesotho, Kenya* (Dours 1869; Cameron 1905; Friese 1905; Eardley 1993).

Other material examined. (*Afromelecta fulvohirta*) **South Africa** • 1♀; Colonie du Cap, Steynsburg; 1914; R. Ellenburger leg,; T.J. Wood det.; MNHN • 1♂; Colonie du Cap, Steynsburg; 1915; R. Ellenburger leg,; T.J. Wood det.; MNHN; (*Afromelecta lieftincki*) **Kenya** • 1♂; Mission de l'Omo, Machacos [Machakos], Wa-Kamba; 1600 m a.s.l.; 1932–1933; C. Arambourg, P-A. Chappuis, R. Jeannel leg.; C. Eardley det.; MNHN (holotype).

Pachymelus (*Pachymelopsis*) *haladai* sp. nov.

https://zoobank.org/BEDC341D-BA3E-43E7-A167-6EDB2B24568A

Holotype. Ethiopia • 1♂; 60 km SSW Negele [probably actually 5.5333°N, 39.4333°E], 1480 m a.s.l.; 24 May 2015; J. Halada leg.; OÖLM.

Diagnosis. *Pachymelus haladai* can swiftly be placed in the subgenus *Pachymelopsis*, as the tarsi lack arolia, the

Figure 7. *Pachymelus festivus* (Dours, 1869) male (NHMUK). **A.** Label details; **B.** Habitus, lateral view; **C.** Head, frontal view; **D.** Hind basitarsus, dorsal view.

first flagellar segment is shorter than the scape, the labrum presents a weak transverse preapical ridge, and T2 has a moderately strong gradulus which does not reach the apical margin of the segment. At a specific level, it can be swiftly recognised due to the combination of a long dense fringe of hairs on the anterior basitarsus (Fig. 9C; as in *P. armatipes*, *P. conspicuus*, and *P. festivus*) and the mid trochanters being strongly produced into long tooth-like projections (Fig. 9E). This places it closest to *P. armatipes*, as *P. conspicuus* and *P. festivus* have the mid trochanters rounded. Separation of *P. haladai* can be made by the shape of the hind basitarsus (Fig. 9F) which in *P. haladai* has a strongly produced acute projection at the base, with the inner surface of the basitarsus distinctly concave (in *P. armatipes* without such a spine, and with the inner margin of the hind basitarsus straight, more or less parallel with the outer surface, Fig. 4D). The shape of the hind basitarsus also allows for separation from *P. conspicuus* (Fig. 2E, hind basitarsus strongly broadened apically, thus triangular) and *P. festivus* (Fig. 7D, hind basitarsus with a small tooth apically, but not basally).

Description. Female. Unknown.

Male. Body length: 18 mm (Fig. 9A). ***Head:*** 1.5 times wider than long, integument dark with yellow maculations on scape, majority of clypeus with exception of black mark basomedially, labrum, and mandibles basally, apexes of mandibles olive-yellow (Fig. 9B). Labrum with weak preapical transverse ridge, surface between preapical ridge and apical margin covered with short buff hairs. Eyes large, inner margins curved, dorsally and ventrally with margins diverging. Galea moderately long, shorter than length of head. Head covered with whitish to buff hairs, hairs not equalling length of scape. Gena approximately 60% diameter of compound eye; ocelloccipital distance slightly exceeding diameter of lateral ocellus. Antennae with dorsal surface dark, ventrally surface from apex of A3 onwards lightened orange, ventral surface of A4–13 additionally with presence of greyish scales. A3 exceeding length of A4, shorter than A4+5; A3 also shorter than antennal scape.

Mesosoma: Scutum densely and shallowly punctate, punctures confluent over majority of surface, becoming sparser posteromedially, separated by 1–2 puncture diameters. Mesepisternum with relatively larger punctures, punctures predominantly dense, separated by <0.5–1 puncture diameter. Mesepisternum with whitish hairs, becoming buff to golden brown dorsally. Fore leg with femur entirely and tibia anteriorly lightened orange. Fore basitarsis slightly broadened, ivory white with anterior surface polished, posterior margin with conspicuous fringe of long golden hairs, fringe greatly exceeding diameter of basitarsus (Fig. 9C); remaining tarsal segments brownish.

Figure 8. *Afromelecta lieftincki* Eardley, 1991 holotype male (MNHN). **A.** Label details; **B.** Habitus, lateral view; **C.** Head, frontal view; **D.** Scutellum, dorsal view; **E.** Forewing, dorsal view; **F.** Metasoma, dorsal view.

Mid leg with femur and tibia anteriorly lightened orange, tibia thickened, apically produced into weakly lamellate margin. Mid basitarsus flattened, lightened yellowish, anteriorly produced into slightly curved blunt point; dorsal surface partially covered in short whitish hairs (Fig. 9D). Trochanter of mid leg ventrally produced into long tooth-like projection (Fig. 9E). Hind leg with femur latitudinally broadened, ventrally surface weakly excavated basally. Hind tibia weakly broadened medially, ventroapically with small acutely pointed tooth; dorsal surface partially covered with short whitish hairs. Hind basitarsus with outer surface flattened, basally with strongly produced acute projection, inner surface distinctly concave, broadening apically (Fig. 9F). All tarsal claws lacking arolia.

Metasoma: Terga dark, apical margins obscurely lightened brownish hyaline. Lateral surface of disc of T2–3 with moderately strong gradulus present, not extending to apical margin. Disc of T1 with erect light brown hairs, apical margin with narrow hairband composed of buff hairs. Apical margins of T2–5 with long white api-

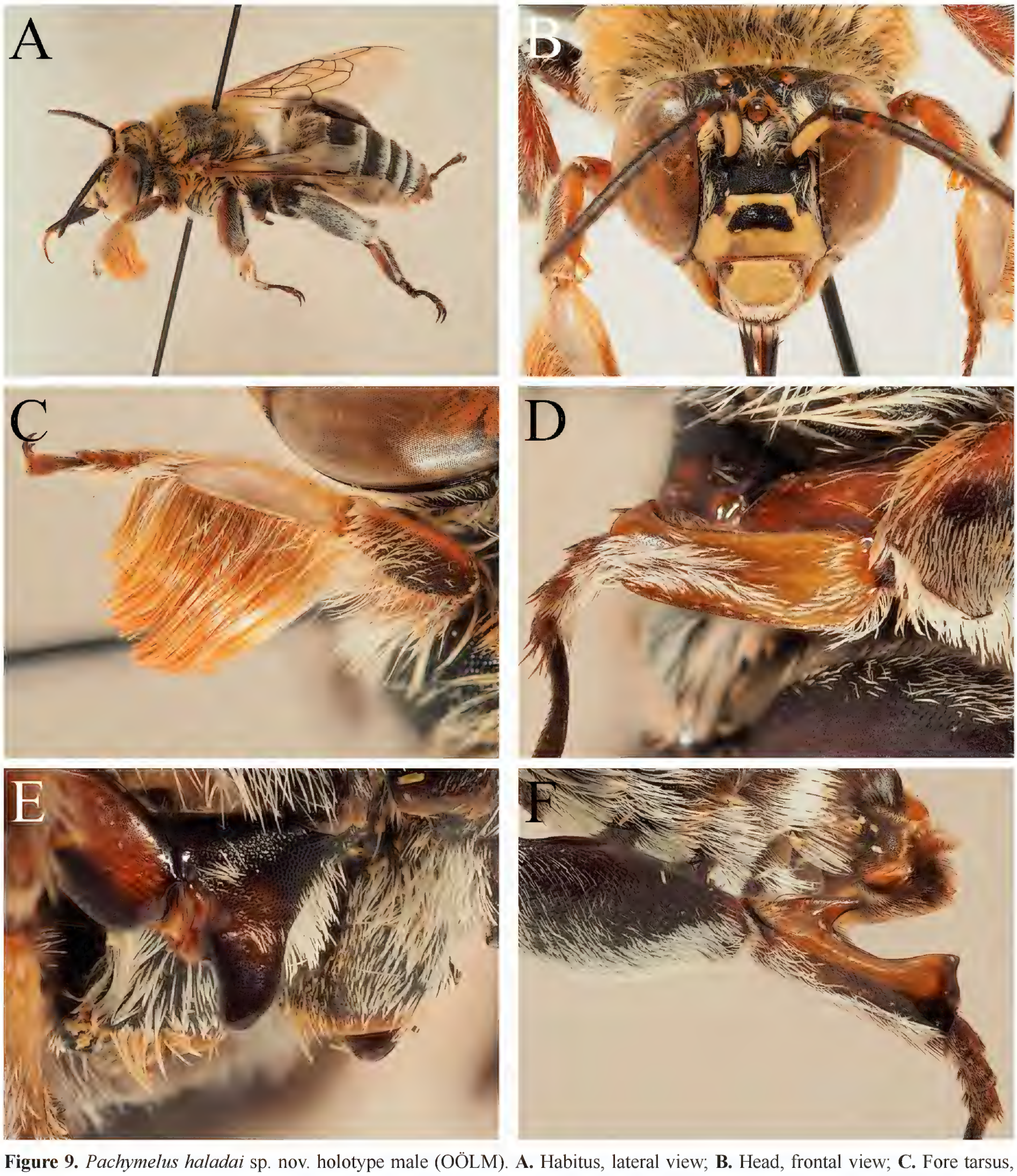

Figure 9. *Pachymelus haladai* sp. nov. holotype male (OÖLM). **A.** Habitus, lateral view; **B.** Head, frontal view; **C.** Fore tarsus, dorsal view; **D.** Mid tarsus, lateral view; **E.** Mid trochanter, anterolateral view; **F.** Hind tibia and basitarsus, lateral view.

cal hairbands occupying entire marginal area. T7 basally with dense orange hairs, becoming dark brown apically; surface with conspicuous pygidial plate, plate rounded triangular, surface obscurely pitted, dull.

Notes. Coordinates were provided on the label, which read: 5°32'N, 39°26'E [5.5333°N, 39.4333°E], approximately 28 kilometres north-west of Negele. The altitude here is about 1,550 m a.s.l., whereas 60 kilometres SSW of Negele is at an altitude of around 800 m a.s.l. The provided coordinates are therefore considered more accurate, as written localities on Halada labels are often indicative rather than absolutely precise.

Etymology. Named after the Czech collector Jiří Halada, who for many years has travelled the world collecting insects, many of which are deposited in the Linz collection and have served as the basis for hundreds of new species descriptions. His collections, along with those of other members of his family, have immeasurably increased our understanding of insect biodiversity.

Distribution. Ethiopia.

Pachymelus (*Pachymelopsis*) *reichardti* Stadelmann, 1898

Pachymelus reichardti Stadelmann, 1898: ♀ [Tanzania, ZMB, not examined].

Anthophora determinata Friese, 1905: 234, ♀♂ [Tanzania, ZMB, not examined].

Material examined. **Kenya** • 1♂; Brit. E. Af., 30 miles from Magadi Junc.; 1–30 Apr. 1912; F.G. Hamilton leg.; T.J. Wood det.; NHMUK • 1♂; Brit. E. Af., Kibwezi; 3,000 ft a.s.l.; 24 Apr. 1911; S.A. Neave leg.; T.J. Wood det.; NHMUK • 3♀; E of Mwingi; 14 May 2007; M. Halada leg.; T.J. Wood det.; OÖLM/TJWC • 1♂; SE, Tsavo Inn., W Mtito Andei; 17 Apr. 2007; M. Snižek leg.; T.J. Wood det.; OÖLM • 1♂; Taita Hills, Voi river; 14 Apr. 2007; M. Halada leg.; T.J. Wood det.; OÖLM • 1♂; Afrique Orient. Angl., Boura (Wa-Taita) [Bura, Taita Hills]; 1–31 Mar. 1904; Ch. Alluaud leg.; T.J. Wood det.; MNHN; **Malawi** • 1♀; Mt. Soche; 19 Mar. 1977; G.G.M. Schulten leg.; C. Eardley det.; RMNH • 2♂; Ntchisi Forest; 5 Apr. 1975; G.G.M. Schulten leg.; C. Eardley det.; RMNH • 22♂, 13♀; Nyasaland, Mlanje; 14 Feb. – 13 Jun. 1913; S.A. Neave leg.; D.B. Baker/C. Eardley/T.J. Wood det.; NHMUK • 1♀; Nyasaland, Mlanje Boma; 2,400 ft a.s.l.; 26 Apr. – 5 May 2010; S.A. Neave leg.; T.J. Wood det.; NHMUK; **Mozambique** • 1♀; Port. E. Africa, Valley of Kola R., nr. E. Mt. Chiperone; 1500–2000 ft a.s.l.; 6 Apr. 1913; S.A. Neave leg.; T.J. Wood det.; NHMUK; **Tanzania** • 1♂; Tanga; 11 Jun. 1985; G.G.M. Schulten leg.; T.J. Wood det.; RMNH.

Notes. The species is here confirmed from Mozambique, close to the border with Malawi, a country in which *P. reichardti* appears to have been commonly collected in localities such as Mulanje. Eardley (1993: 225) wrote that "Lieftinck (1973) mentioned that it occurs in Mozambique but did not give the precise locality". However, this actually refers to Lieftinck (1972: 315), who mentioned *P. reichardti* (as *Habropoda determinata*) from "Portuguese E. Africa". This may have referred to the NHMUK specimen, but in any case, the species is now demonstrated to occur in this country.

Distribution. Kenya, Tanzania, Malawi, Mozambique (Stadelmann 1898; Friese 1905; Eardley 1993).

Updated identification key to continental African *Pachymelus* species

The key of Eardley (1993) is here updated and modified, taking into account the taxonomic changes proposed in this study, as well as the placement of *Pachymelus peringueyi* (Friese, 1911) in *Pachymelus* s. str. (Michener 2007). Females of *P. abessinicus* (Friese, 1912) and *P. haladai* are currently unknown (see Eardley 1993). The illustrations in Eardley (1993) are highly valuable and should be consulted, taking into account the taxonomic changes proposed here.

1 Arolia present between the tarsal claws. Labrum without a transverse preapical ridge. Female clypeus entirely black, without any yellow maculations. Found in western South Africa and Namibia. *Pachymelus* (*Pachymelus* s. str.) ***P. peringueyi* (Friese)**

– Arolia absent. Labrum with transverse preapical ridge, often broken. Female clypeus with yellow maculations of variable extent. Found in Southern and Eastern Africa from south-central South Africa to Ethiopia. *Pachymelus* (*Pachymelopsis*) **2**

2 Twelve antennal segments, six visible metasomal segments; females **3**

– Thirteen antennal segments, seven visible metasomal segments; males **6**

3 Mesepisternum and entirety of mid-leg with abundant black pubescence (Figs 1C, 3C) **4**

– Mesepisternum and mid-leg with almost entirely pale pubescence, at most with scattered black hairs (Figs 5B, 6B) **5**

4 Terga with fine and dense orange pubescence, not seeming to form apical hairbands (Fig. 1D). Scutum with finely intermixed greyish and dark brown hairs (Fig. 1B–C). Facial markings lemon yellow (Fig. 1C). Slightly smaller, 15–16 mm in length ***P. conspicuus* Smith**

– Terga with relatively coarse orange-brown pubescence, weakly forming apical hairbands (Fig. 3D). Scutum with rich reddish-brown hairs, at most with few intermixed black hairs (Fig. 3A, C). Facial markings ivory yellow (Fig. 3B). Slightly larger, 16–18 mm in length ***P. armatipes* (Friese)**

5 Terga with pale pubescence even, uniformly covering the tergal surfaces (Figs 5D, 6D). Face with pale markings typically presenting as a yellow spot on the clypeus, with the labrum and mandibles dark (Fig. 5C). Some specimens from Kenya can show small pale markings at the base of the mandibles (Fig. 6C) ***P. festivus* (Dours)**

– Terga with pale pubescence uneven, T2–3 with distinct subapical crossbands of black hairs interrupting pale pubescence. Clypeus with majority of anterior margin yellow-marked, with yellow markings also across base of mandibles ***P. reichardti* Stadelmann**

6 Fore basitarsus with a conspicuous fringe of long pale hairs (Figs 2D, 4C, 9C) **7**
– Fore basitarsus without such a conspicuous hair fringe **10**

7 Mid legs with the trochanters produced into long ventrally-projecting teeth (Fig. 9E) **8**
– Mid legs with the trochanters rounded, not noticeably elongate **9**

8 Hind basitarsus with a strong acute projection basally, with the inner surface distinctly concave (Fig. 9F) ***P. haladai* sp. nov.**
– Hind basitarsus without an acute projection basally, with the inner surface straight, more or less parallel with the outer surface (Fig. 4D) ***P. armatipes* (Friese)**

9 Hind basitarsus strongly broadened apically, thus appearing triangular (Fig. 2E). Apex of hind basitarsus rounded to blunt. Dorsal surface of hind basitarsus with a distinct posterior fringe of white hairs, the remaining surface glabrous ***P. conspicuus* Smith**
– Hind basitarsus weakly broadened apically, not obviously appearing triangular (Fig. 7D). Apex of hind basitarsus produced into a small tooth or angulation. Dorsal surface of hind basitarsus entirely covered with pale pubescence ***P. festivus* (Dours)**

10 Discs of T2–4 predominantly black-haired with a very pale yellowish-white anterior fringe, without pale hairs covering the disc. Hind femur strongly broadened, appearing swollen. Hind tibia curved and apically thickened, ventrally extending into a broad, yellowish, and blunt projection ***P. abessinicus* (Friese)**
– Discs of T2–4 with pale yellowish to orange vestiture anteriorly and posteriorly, with a distinct black subapical cross-band, not predominantly black-haired. Hind femur not noticeably broadened. Hind tibia apically produced into a yellowish acutely pointed projection ***P. reichardti* Stadelmann**

Discussion

The findings presented here clarify several outstanding issues in *Pachymelus* (*Pachymelopsis*). Although males display a highly distinctive morphology, characters allowing confident sex association are essentially absent, meaning that workers must examine many specimens from across the range of different taxa to make reliable associations. Although the description of new species based on single specimens that inevitably represent only one sex (i.e. Cockerell 1910) has caused confusion in understanding this subgenus of bees, the morphology of *P. haladai* is so distinctive, and males are now confidently known from all other species, that its description is warranted.

In addition to this description and clarification of sex associations, the study of additional material and integration of published literature allow confident recognition of Kenya as the centre of diversity for *Pachymelus* (*Pachymelopsis*), with five of the six species present in the south of the country (Table 1). Although not home to the explosive undescribed bee diversity of South Africa (e.g. Kuhlmann 2025; Pöllein and Kuhlmann 2025), Kenya has received attention over the past decade with the description of new and unusual bee species (e.g. Patiny et al. 2013; Pauly 2014; Dathe 2014; Ascher and Engel 2017; Bossert and Pauly 2019; Bossert et al. 2020).

It is not merely that new species have been described from Kenya, but that the nature of these bee species is noteworthy, representing unusual lineages such as *Mermiglossa* Friese, 1912 and *Schwarzia* Eardley, 2009. In particular, southern Kenya hosts many dry and xeric habitats, which are relatively unusual within the Afrotropics until one approaches the southern part of the continent (e.g. Namibia, South Africa). At a global scale, seasonally xeric habitats are known to support high bee diversity (Orr et al. 2021), so it is unsurprising that new bees

Table 1. Known distributions of the six *Pachymelus* (*Pachymelopsis*) species. The *terra typica* are in bold.

Species	Distribution	Reference
Pachymelus abessinicus (Friese, 1912)	**Kenya**, Tanzania	Friese (1911); present study
Pachymelus armatipes (Friese, 1911)	Ethiopia, **Somalia**, Kenya	Friese (1911); Eardley (1993); present study
Pachymelus conspicuus Smith, 1879	Ethiopia, Kenya, Tanzania, **Malawi**, Zambia, Namibia	Smith (1879); Cockerell (1910); Eardley (1993); present study
Pachymelus festivus (Dours, 1869)	**South Africa**, Lesotho, Kenya	Dours (1869); Cameron (1905); Friese (1905); Eardley (1993); present study
Pachymelus haladai sp. nov.	**Ethiopia**	Present study
Pachymelus reichardti Stadelmann, 1898	Kenya, **Tanzania**, Malawi, Mozambique	Stadelmann (1898); Friese (1905); Eardley (1993); present study

are being described from southern Kenya. What is more remarkable is that a biogeographic link has emerged between southern Africa and southern Kenya; the genus *Mermiglossa* was considered endemic to the Namib Desert until the description of a Kenyan species (Ascher and Engel 2017). In this context, the new records of *P. festivus* from southern Kenya are more understandable, despite the lack of records from the intervening areas of Zimbabwe, Zambia, Malawi, and Tanzania. It remains to be established whether *Afromelecta fulvohirta* is also present in both southern and eastern Africa as a single species with a disjunct distribution.

As discussed by Ascher and Engel (2017), other East African countries have lower documented bee species richness than Kenya, but it is highly likely that the Ethiopian fauna is strongly under-recorded, with currently just over 200 documented species (Ascher and Pickering 2025). The presence of such a large and morphologically distinct species as *P. haladai* strongly suggests that many more bee species await discovery and description in this region.

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